Back to the Future

JSC Engineering Excellence
to Meet the Challenges
of Human Space Flight

Mike Conley
6 December 2005

Let's go back in history

- Original JSC Engineering Model for the Apollo and Shuttle Programs
- Engineering was organized by Major Disciplined Divisions
  - NASA Subsystem Manager (SSM) provided the technical oversight of the contractor for the Program
    - Worked in engineering under the strength of the Division
    - Reported to the Division
    - Matrix to the Project Office
      - Project Office was Outside the Program
    - Also provided oversight to GFE projects
    - WAS THE "TECHNICAL AUTHORITY" FOR THE SUBSYSTEM

History (continued)

- Director of Engineering was “defacto” Engineering Authority for the program.
  - Engineering Directorate accountable for all products delivered
  - Technical issues between SSM and Project management brought to Engineering Director to formulate formal Engineering position
    - Issues which could not be solved between Engineering and Project elevated to Center Director for resolution

History (continued)

- Under privatization of the Orbiter project, SSM responsibility transitioned to contractor
  - JSC engineering evolved into an insight role
    - Oversight role remained for “out of family” only
  - Engineering Divisions moved on to other ventures and started down sizing
  - Erosion of NASA Engineering expertise

History (continued)

Model for ISS Program:

- Initially, no or very little JSC engineering oversight role
  - No SSM role
  - ISS Program moved engineering into program office and established System Manager (SM) role.
  - Introduced an ISS Program Chief Engineer Position
- SM transferred to Engineering to provide division level strength and support (As previously modeled in the early Shuttle era)

Transformation of JSC Engineering After STS-107

- Following the STS-107 accident, JSC Engineering Director began a transition of JSC engineering to renew the technical focus.
  - **Shuttle NASA System Engineer (NSE) role established**
    - **Original concept recommended by the Orbiter Project shortly before the accident**
    - **NSE an addition to the Contractor SSM Team**
    - **NSE Role to provide the government oversight and accepts all products for NASA**
  - **A review team was chartered with folks directly involved with the STS-107 foam loss and others to look at the engineering directorate communication processes to focus on the process breakdowns and recommend improvements**
    - **How to get the Engineering issues and position elevated to the proper level in Engineering and the Program?**

Transformation (cont)

- Engineering Directorate level review of all Shuttle and ISS change traffic. (Weekly or as required)
- Special significant issue reviews
  - Analysis based, subject matter experts
  - Risk discussions based on what we know and what we don't know
  - Reviews are independent
- Bottom line: JSC ENGINEERING WILL HAVE A POSITION ON ALL TECHNICAL ISSUES.
  - We owe the program a solid technical solution with risks identified.

Independent Technical Authority

- Modeled after the Navy
  - Warrants awarded for System and Discipline areas
    - Personal authority
      - Trusted agent network with subject matter experts
      - Still required a structure to get the institutional support
  - JSC structure was already in place to support the iTA concept
    - Shuttle and ISS Chief Engineer
      - Engineering Office Staff for direct support to boards and panels for the Chief Engineer
        - » Integration of the Engineering position
      - Division infrastructure already established and working
    - We took advantage of the established structure and networked in the new Discipline Warrant Holders for resolution of significant technical issues
      - NSEs, SSMs, and SMs “first line of defense”

iTA Implementation with the Program

- Processes added in Program Configuration Management to include iTA approvals
  - Waivers, Deviations and exceptions
  - Changes to program baseline
  - System Warrant Holder certified flight readiness with Program manager.
- iTA membership added to all Boards and Panels
  - SSP – Engineering Director and iTA separate board members
  - ISS – single Engineering Directorate/iTA board member

Completing the Transition

- JSC Engineering Director will be the “technical authority” for the support to programs/projects under JSC engineering’s purview
  - Already have a Engineering Directorate Chief Engineer assigned to each program to provide day-to-day involvement with the Programs/Projects.
    - Represent Engineering at Program/Projects boards/panels
    - Approve all waivers, deviations and exceptions to the Program requirements
    - Approve technical requirements
    - Conduct special independent reviews as deemed needed.
    - Provide the engineering integration
    - Improving ties with S&MA organization for integrated risk and hazard analysis
  - Issues between Engineering and Program to be vetted through the JSC Center Director, Mission Directors, AA, OCE and OSMA.

Going “Back to the Future” using a proven engineering structure from the Apollo/Shuttle era will provide an Engineering Technical Excellence organization needed to successfully meet the challenges of Human Space Flight